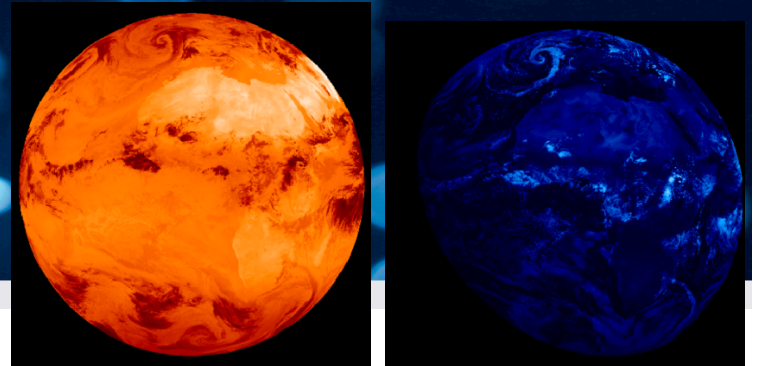
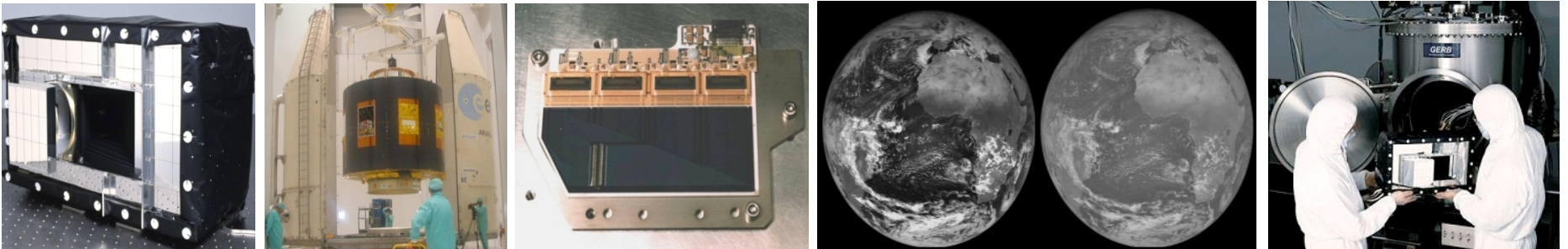


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## GERB Programme status



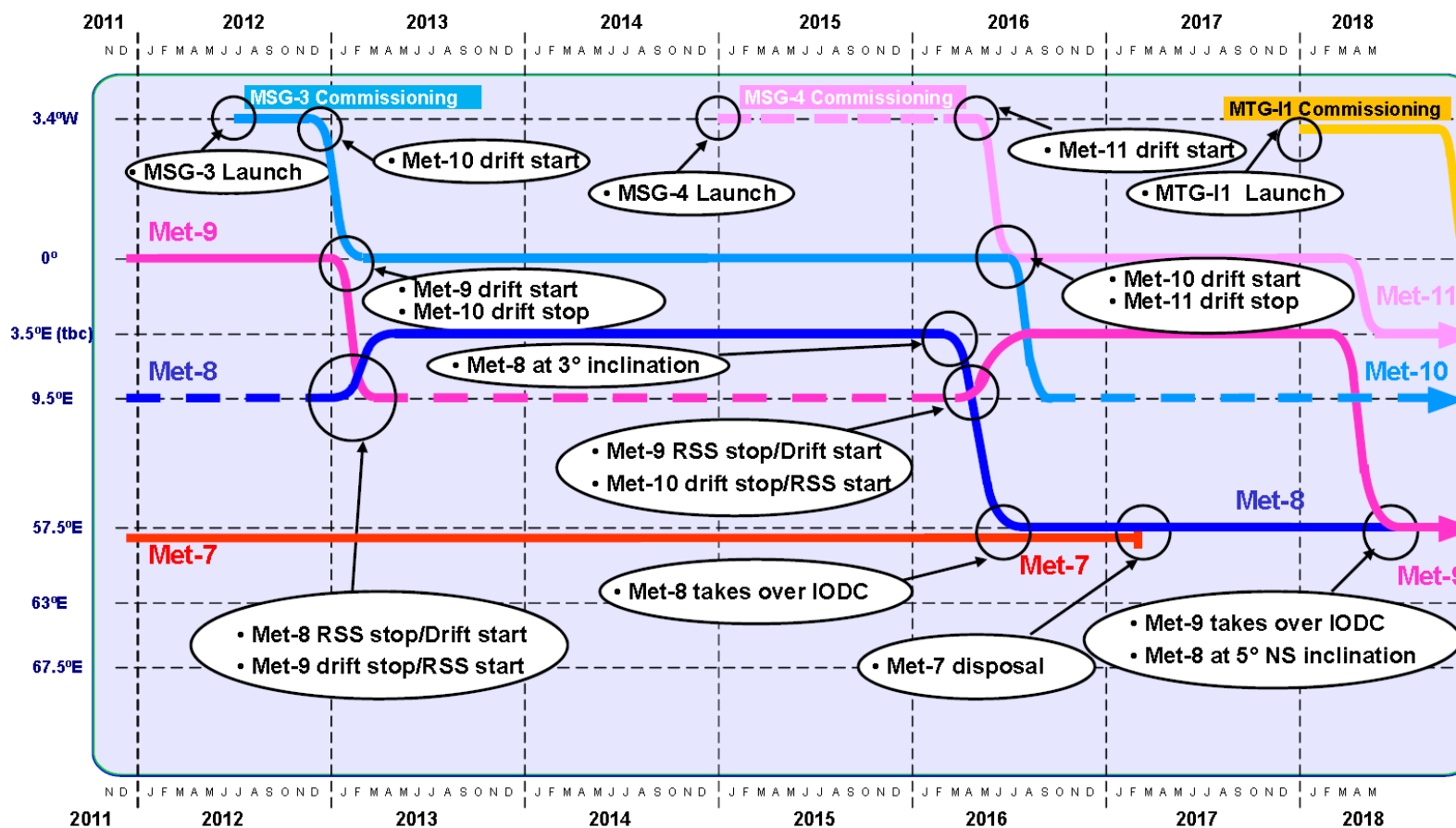
Jacqui Russell, (GERB project scientist) Imperial College

## Geostationary Satellite Status

- MET-9 (MSG-2 / GERB-1) Current prime operational satellite in geo orbit at 0°. SEVIRI fulfilling the Full Disc Scanning Service, GERB current operational record.
- MET-8 (MSG-1 / GERB-2) at 9.5°E. SEVIRI is fulfilling the Rapid Scanning Service (RSS), occasional calibration and special activation of GERB
- MET-10 (MSG-3 / GERB-3) at 3.5°W (5<sup>th</sup> July launch) in commissioning
- GERB 4 about to come to Imperial for recalibration

## Geostationary Satellite Status

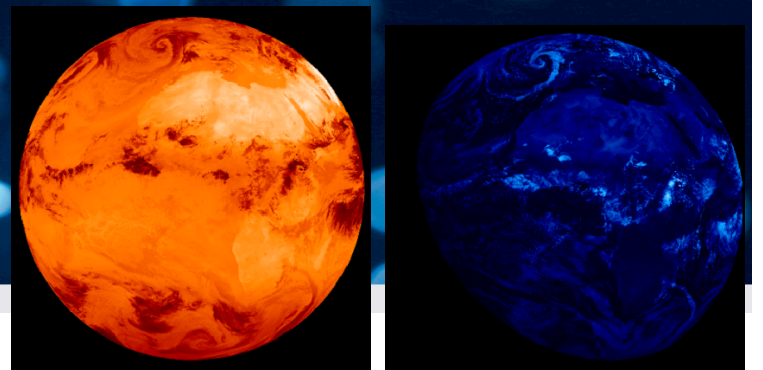
### Meteosat Long-Term Planning Perspective



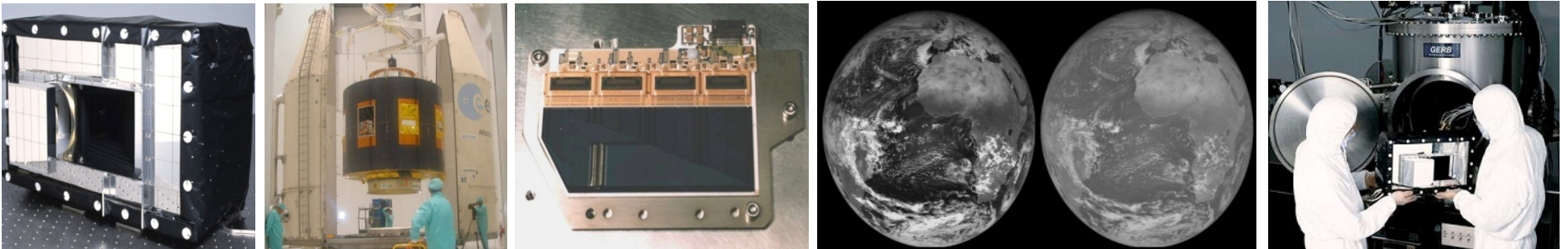
## **MSG-4 Satellite**

- The MSG-4 satellite is stored in Cannes, however a few items are stored separately (e.g. GERB-4 at RAL), and the SEVIRI drive unit has still to be exchanged. A new drive unit is under manufacturing.
- Launch planning: EUMETSAT will recommend to its Council a plan for MSG-4 launch in early 2015.
- EUMETSAT currently predict that the MSG-4 satellite will not be needed for operation immediately and so would remain under 'in-orbit storage'.
- The need date for GERB-4 in Cannes in mid to late 2013.

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## GERB: data, calibration & plans



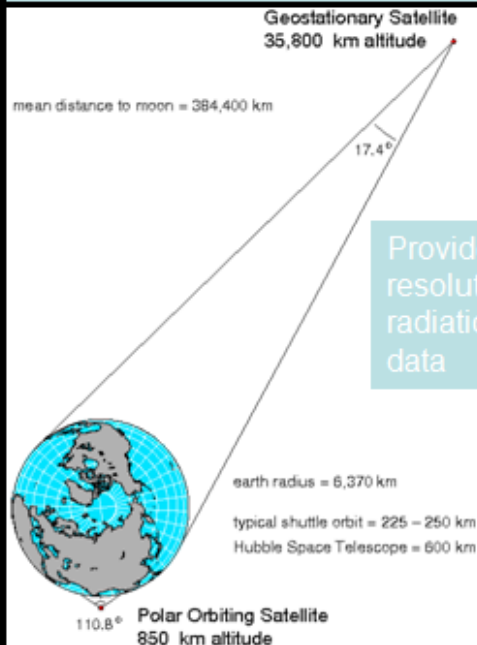
Jacqui Russell, (GERB project scientist) Imperial College



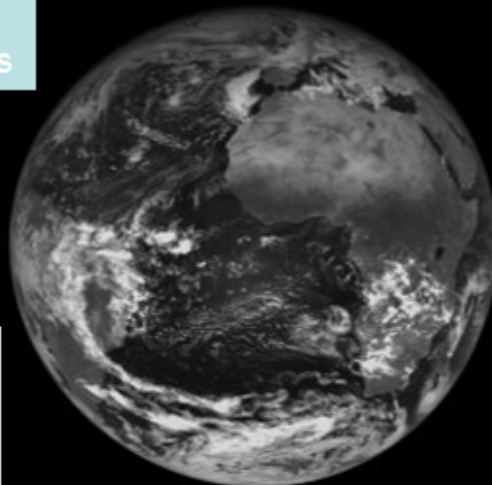
## GERB observations

GERB observes the  
Earth in two channels

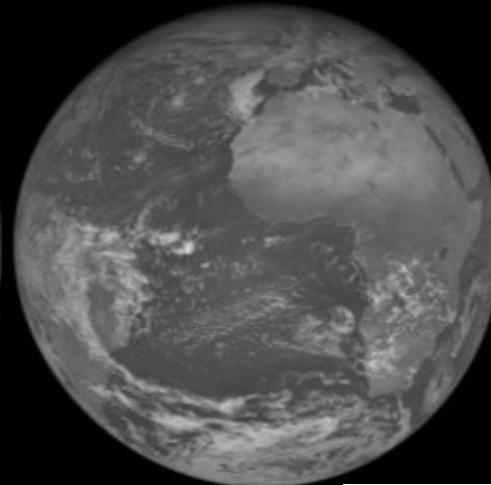
GERB is the first and only  
geostationary broadband  
radiometer



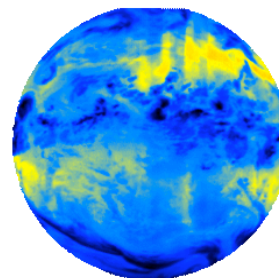
Shortwave channel ( $\lambda=0.3-4.0\mu\text{m}$ ):  
reflected solar energy



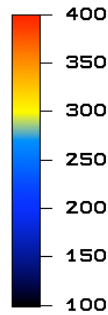
Total channel ( $\lambda=0.3->100\mu\text{m}$ ):  
reflected solar + emitted thermal energy



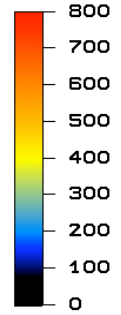
Emitted Thermal Flux ( $\text{W/m}^2$ )



20070817 000556



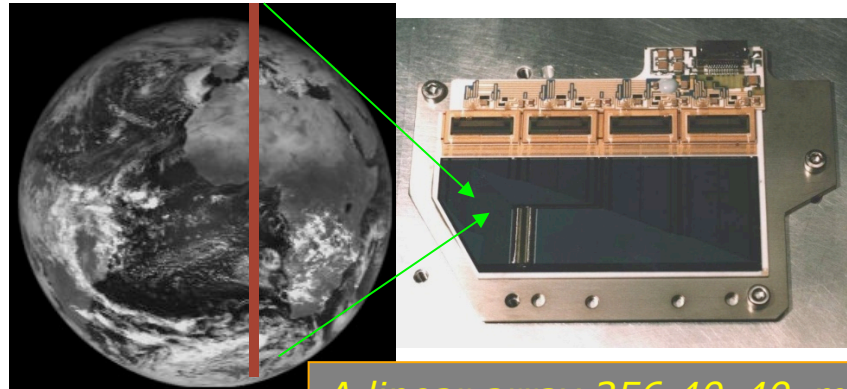
Reflected Solar Flux ( $\text{W/m}^2$ )



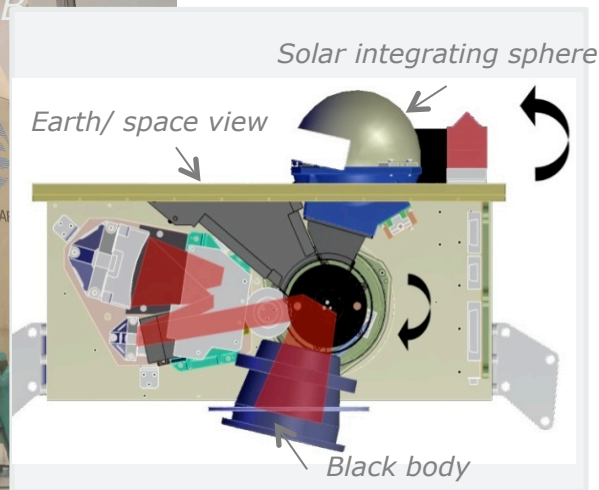
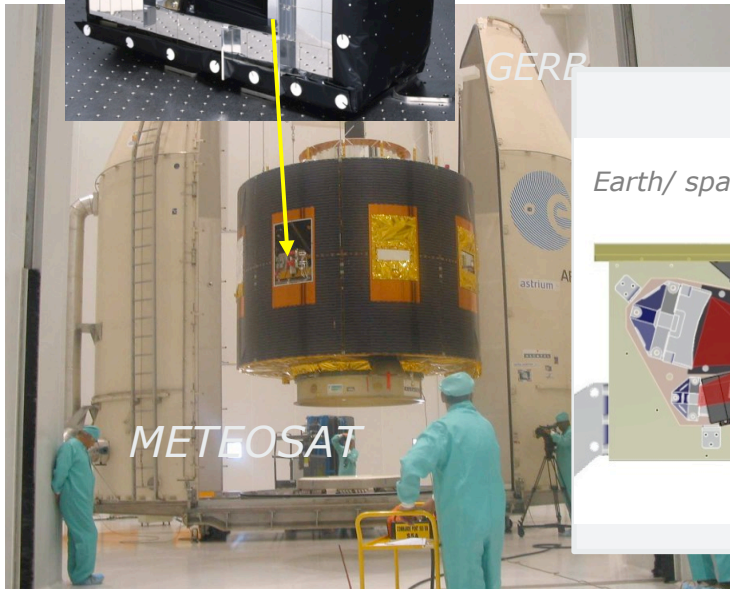
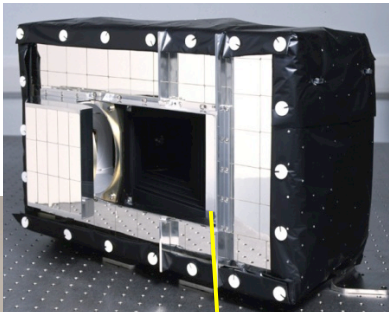
20070817 000556

## GERB measurements

GERB is mounted on the edge of METEOSAT which spins 100rpm, uses a rotating mirror (operating under 16g) to counter the spin of satellite and achieve a 40ms view of the Earth each rotation



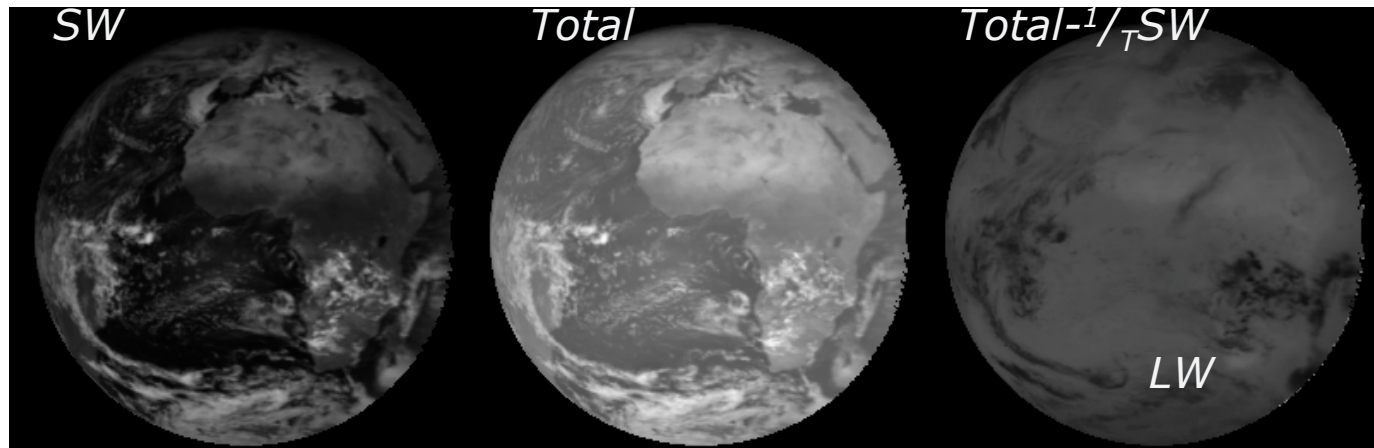
A linear array 256  $40 \times 40 \mu\text{m}$  detectors view the Earth in 282 columns



Each 0.6s GERB obtains a view of a thin strip of Earth, and views of internal calibration targets

282 rotations comprise an image in one channel, the quartz filter is then moved and the second channel observation obtained

## GERB data



*SW gain*

*SW spectral response*

*SW PSF*

*TOTAL gain*

*TOTAL spectral response*

*TOTAL PSF*

*SEVIRI imager used for geolocation, unfiltering, PSF correction,  
SW scene ID to select (TRMM) ADM,  
LW empirical radiance to flux*



## GERB calibration

### GROUND calibration:

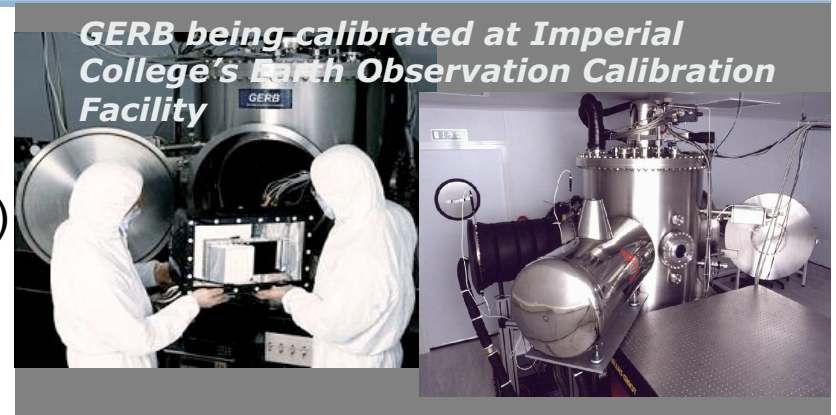
#### Component level measurements

(256 detectors, 1 quartz filter, 5 mirrors (samples))

#### System level characterisation

(spectral response, point spread function,  
internal black body calibration,

instrument SW and TOT gains and gain ratio, filter transmission)



### IN ORBIT calibration

#### Instrument gain (from internal black body)

#### Solar Diffuser scans

monitored by photodiodes at 3 wavelengths,

photodiode response monitored by direct solar illumination

#### Lunar scans

## GERB data

### PRODUCTS:

#### **L1.5: Non Averaged Non Rectified Geolocated (NANRG) Ed 1**

filtered radiances (3 SW & 3 TOTAL scans ~17 mins),  
available <http://ggsps.rl.ac.uk> quality summary available

#### **L2.0: Averaged Rectified Geolocated (ARG) Ed 1**

unfiltered SW & LW radiances and fluxes  
3 scan average (PSF effect not removed)  
available <http://badc.nerc.ac.uk> quality summary available

#### **L2.0: Binned Averaged Rectified Geolocated (BARG)**

awaiting fill field before released on BADC as Ed 1  
unfiltered gridded SW & LW radiances & fluxes  
15 minute uniform average over grid point 50 km sub satellite grid point  
available <http://gerb.oma.be> no specific quality summary but see ARG QS

#### **L2.0: High Resolution (HR)**

non originally envisaged as climate product Edition release TBD  
Resolution enhanced gridded SW & LW radiances & fluxes  
15 minute snapshot at SEVIRI acquisition time  
10km (3x3 SEVIRI pixels) sub satellite  
available from <http://gerb.oma.be>

## GERB data

### DATA RECORDS:

- METEOSAT-8**    **(GERB 2) April 2004 – May 2007**  
Data available from  
<http://ggsps.rl.ac.uk>  
<http://badc.ac.uk>  
<http://gerb.oma.be>  
NB users should multiply SW by 0.974
- METEOSAT-9**    **(GERB 1) May 2007 – January 2013**  
Data available from  
<http://ggsps.rl.ac.uk>  
<http://badc.ac.uk> (up to mid 2012)  
<http://gerb.oma.be> (NRT)
- METEOSAT-10**    **(GERB 3) Feb 2013? –**

*All data uses fixed ground calibration.*

*Edition 2 will address the differences in instrument calibration and calibration stability*

## **GERB team**

Satellite operation: EUMETSAT

Funded GERB team:

- 2.25 FTE at Rutherford (L0 to L1.5 processing)

- 3 FTE at RMIB (L2 processing)

- 2 FT at Imperial (Project Scientist & Instrument Ops)

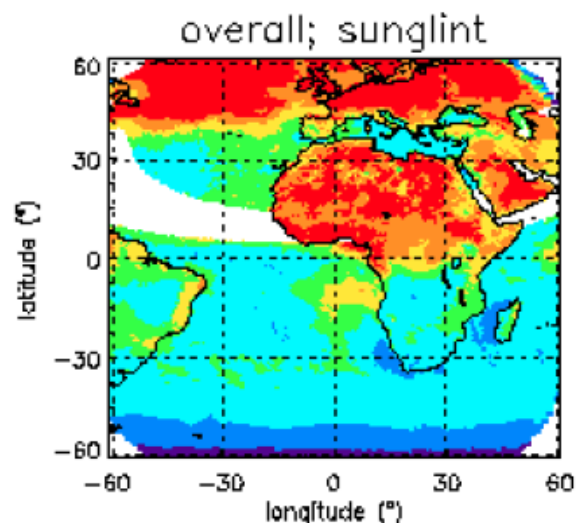
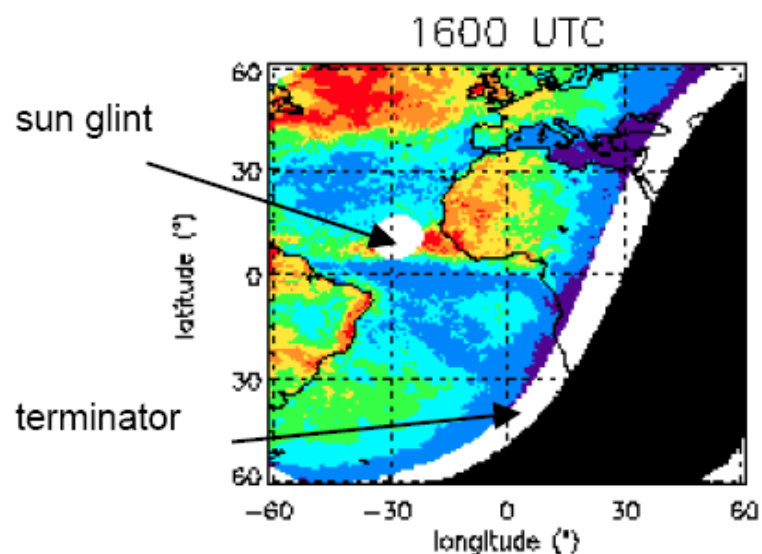
- + targeted funding for ground calibration (1.5 FTE for 18 months) and in-orbit cross calibration (1 FT for 18 months)

## Current status / future plans

- GERB 3 launched 5<sup>th</sup> July 2012, instrument commissioning almost complete, about to begin GERB 3 science validation
  - Initial launch calibration parameters follow same procedure as previous GERBs
  - But GERB 3 ground measurements more extensive so additional information is available
- Approximately 2 months work remaining to produce BARG fill field to enable release of the BARG including these data.
- Subsequent to the cross calibration: Edition 2 will put GERB 1, 2 & 3 on single scale and address changes in calibration during in-orbit operation.

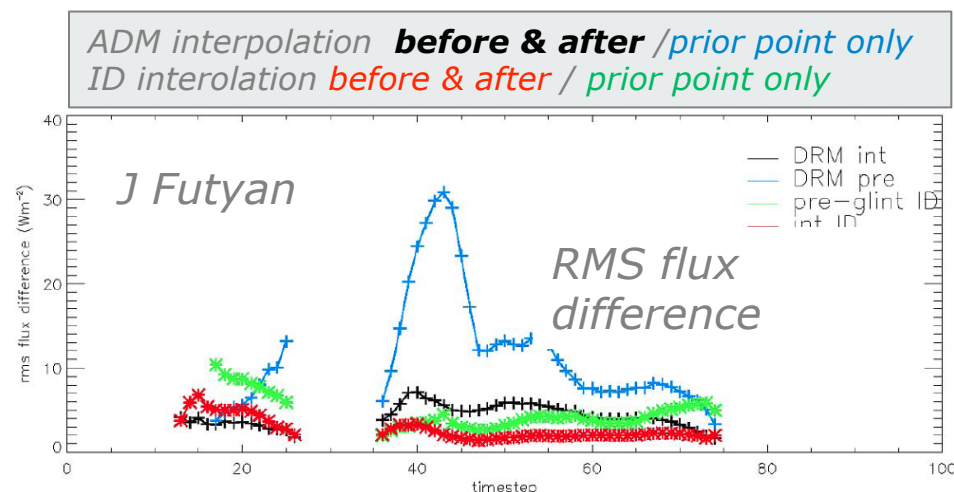


## Missing data and monthly averages



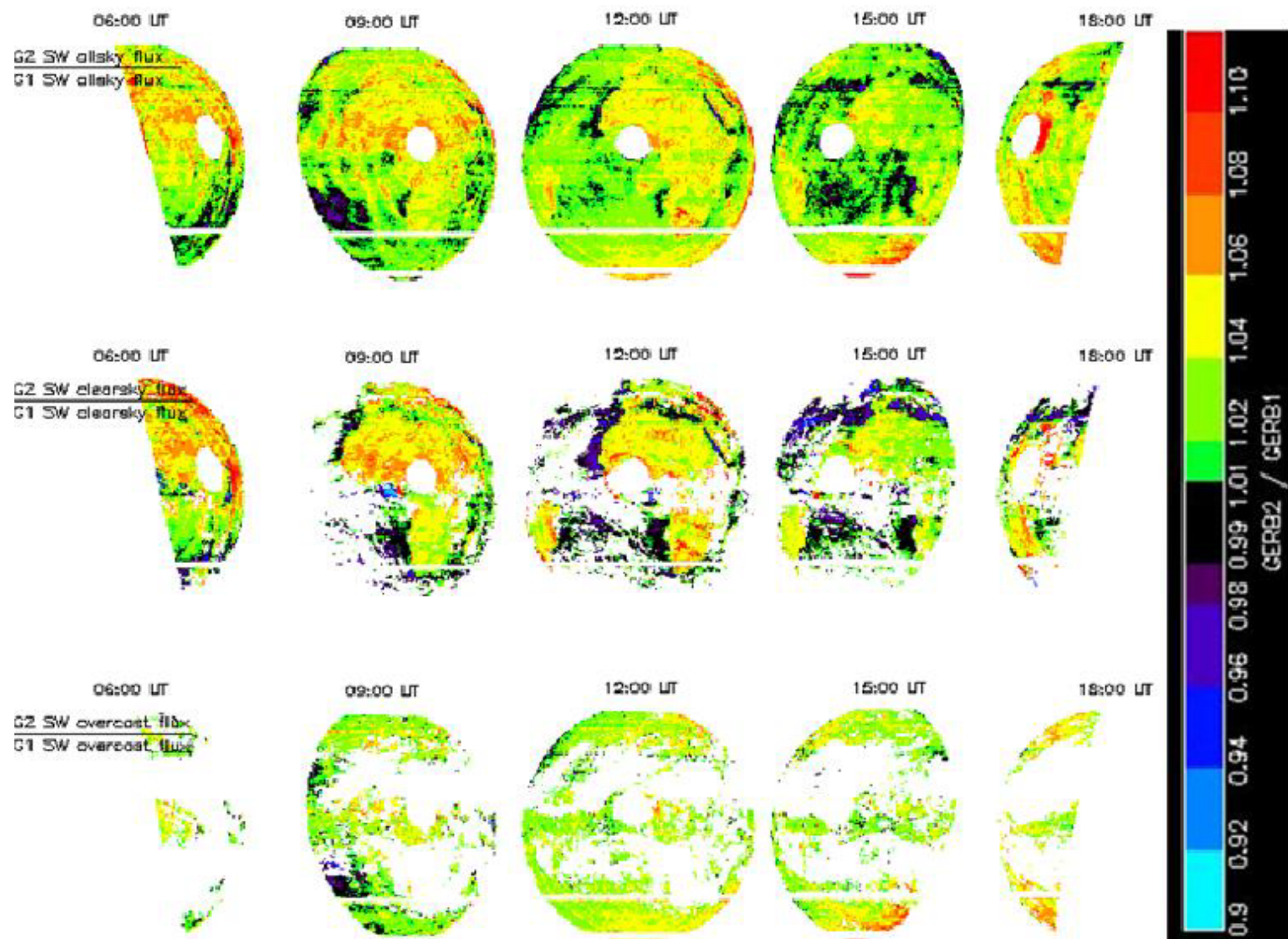
Over ocean, under certain viewing geometries spectral reflection leads to very bright shortwave radiances. Leads to 2 problems:

1. Scene identification using visible channels becomes unreliable  
-SOLUTION INTERPOLATE SCENE ID
2. If the scene is clear converting 'glint' affected radiances to flux is unreliable.  
-SOLUTION fill with 'average' ocean flux

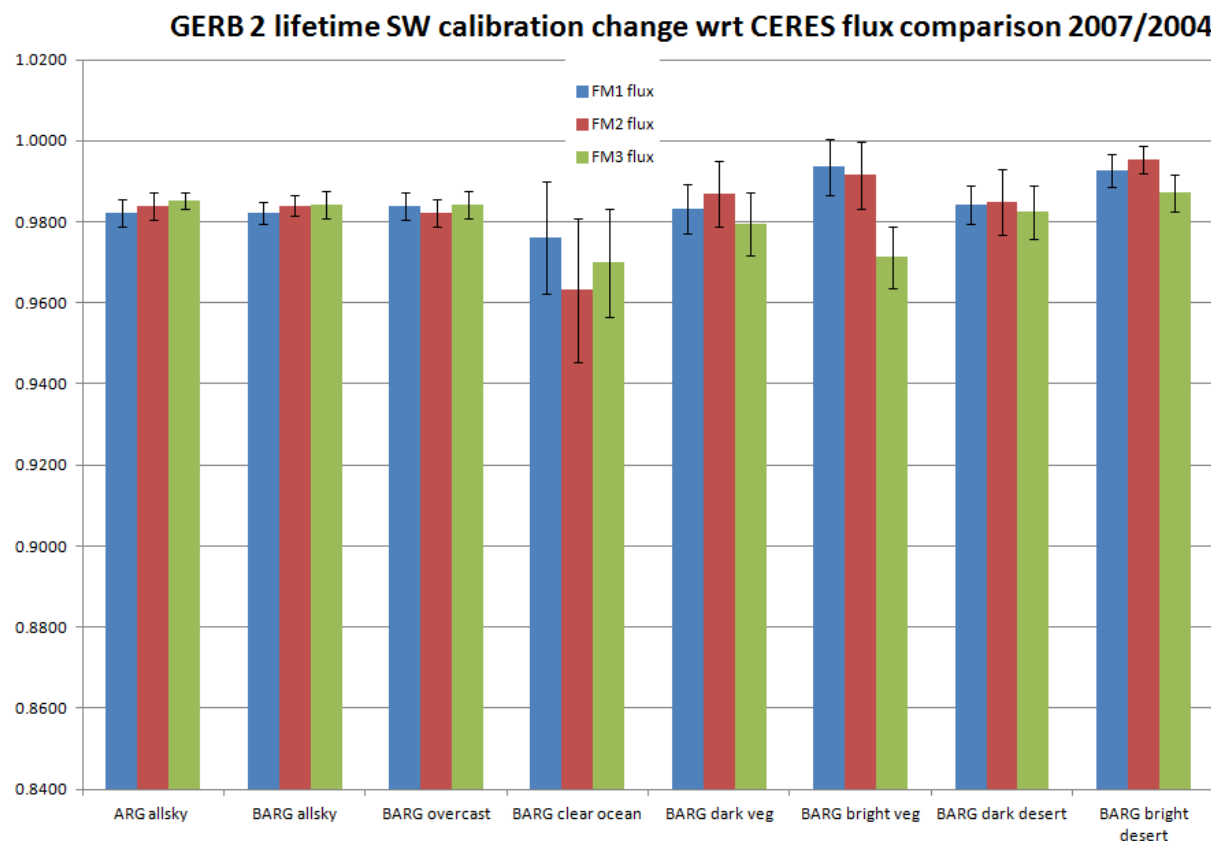


Comparison of ways to fill missing 'glint' data, based on a study in a non-glint region.

## GERB 2 / GERB 1 differences



## 2004 to 2007 GERB 2 / CERES comparisons

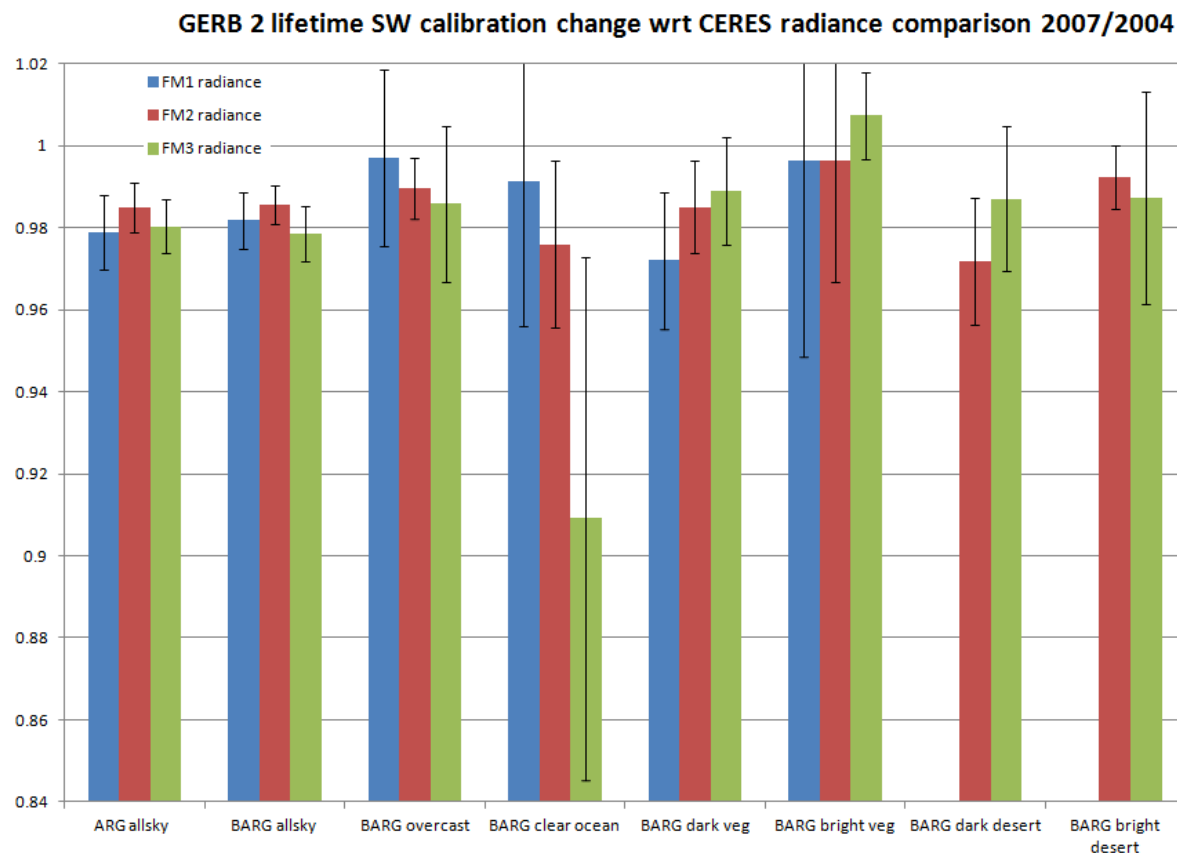


*Flux comparison implies:*

*GERB 2 SW darkening by 1.8% over 3 year averaged over all scenes, with scene variation ( <1% for bright desert, between 2.4 to 4% for clear ocean)*

*Differences in GERB 2 (Swupdate) and CERES (SSF Ed 2 rev1) flux ratio in 2007 and 2004.*

## 2004 to 2007 GERB 2 / CERES comparisons

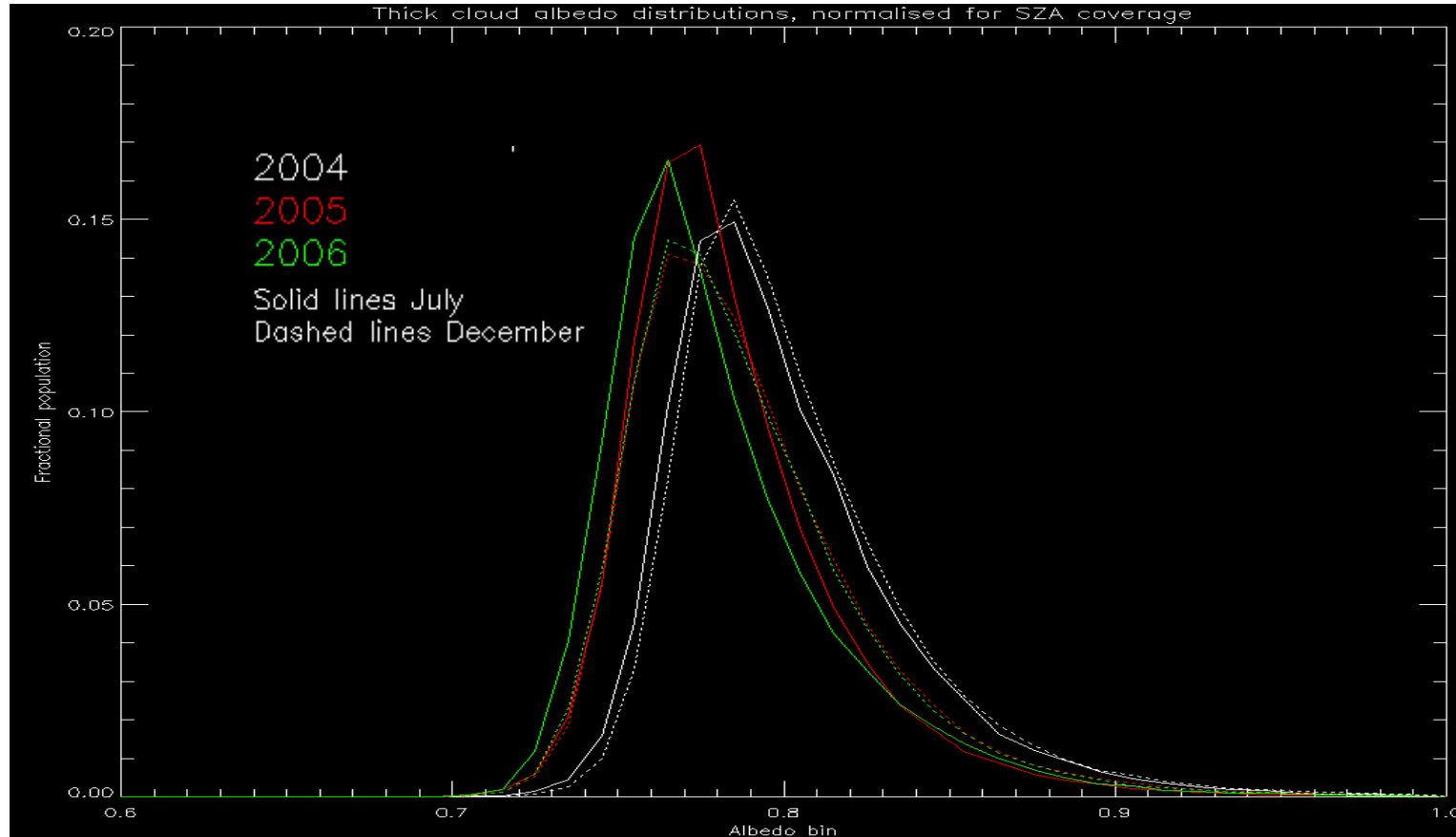


*Radiance comparison implies:*

*GERB 2 SW darkening by a similar 1.6% (FM2) over 3 year averaged over all scenes, and a clear ocean change of 2.4% (FM2) and little indication of significant change to bright vegetation and bright desert.*

*Differences in GERB 2 (Swupdate) and CERES (SSF rev1) flux ratio in 2007 and 2004.*

## Thick cloud albedo distribution



*Shift in the distribution of thick cloud between 2004 and 2005, equivalent to around 1.5 - 2% reduction in albedo.*



## Geostationary Earth Radiation Budget project

- GERB on METEOSAT-8 (April 2004-May 2007)
- GERB on METEOSAT-9 (May 2007 – mid 2012)
- Available from the BADC, RMIB archives
- A fill field for the BARG and HR products requires 2 months effort for release
- GERB on METEOSAT-10 in commissioning expected to become the operational instrument from early 2013
- GERB 4 about to be recalibrated at Imperial
- Subsequent to cross calibration of GERB 3 and GERB 1, we plan complete the studies required to tie the three records and correct for in-orbit calibration changes enabling a consistent combined record for Edition 2

**STOP NOW**